

# Racial Variation in Breast Cancer Treatment Among Department of Defense Beneficiaries

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**BACKGROUND:** Although the overall age-adjusted incidence rates for female breast cancer are higher among whites than blacks, mortality rates are higher among blacks. Many attribute this discrepancy to disparities in health care access and to blacks presenting with later stage disease. Within the Department of Defense (DoD) Military Health System, all beneficiaries have equal access to health care. The aim of this study was to determine whether female breast cancer treatment varied between white and black patients in the DoD system. **METHODS:** The study data were drawn from the DoD cancer registry and medical claims databases. Study subjects included 2308 white and 391 black women diagnosed with breast cancer between 1998 and 2000. Multivariate logistic regression analyses that controlled for demographic factors, tumor characteristics, and comorbidities were used to assess racial differences in the receipt of surgery, chemotherapy, and hormonal therapy. **RESULTS:** There was no significant difference in surgery type, particularly when mastectomy was compared with breast-conserving surgery plus radiation (blacks vs whites: odds ratio [OR], 1.1; 95% confidence interval [CI], 0.8-1.5). Among those with local stage tumors, blacks were as likely as whites to receive chemotherapy (OR, 1.2; 95% CI, 0.9-1.7) and hormonal therapy (OR, 1.0; 95% CI, 0.6-1.4). Among those with regional stage tumors, blacks were significantly less likely than whites to receive chemotherapy (OR, 0.4; 95% CI, 0.2-0.7) and hormonal therapy (OR, 0.5; 95% CI, 0.3-0.8). **CONCLUSIONS:** Even within an equal access health care system, stage-related racial variations in breast cancer treatment are evident. Studies that identify driving factors behind these within-stage racial disparities are warranted. *Cancer* 2012;118:812-20. © 2011 American Cancer Society.

**With** 207,090 new diagnoses and 39,840 deaths estimated for 2010, breast cancer is the most commonly occurring cancer among women in the United States and is the second most common cause of cancer death.<sup>1</sup> Although the overall age-adjusted incidence rates for female breast cancer are higher among whites than blacks, mortality rates are higher among blacks.<sup>1</sup>

Analyses of national data have indicated that the racial disparity in breast cancer mortality started to emerge in the 1970s and continues to grow.<sup>2,3</sup> The reasons for the disparity are likely multifactorial, but black women tend to present with later-stage disease compared with white women.<sup>4</sup> However, racial disparities in mortality have been observed among women with similar staged tumors. These within-stage disparities have been shown to be independent of other tumor characteristics and more pronounced among later stage tumors and among women <65 years of age.<sup>5,6</sup> Therefore, factors other than tumor characteristics may be influential.

Variations in health care access and cancer treatment may partially account for racial disparities in breast cancer mortality. Although not all,<sup>7-9</sup> some studies have found racial differences with respect to breast cancer treatment.<sup>10-15</sup>

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Although many of these studies have been conducted among Medicare recipients<sup>11,13,15</sup> or have adjusted for insurance status,<sup>10,12</sup> residual racial differences in health care access may have existed. The Department of Defense (DoD) Military Healthcare System (MHS) provides universal health care to all racial groups and offers a unique opportunity to investigate racial disparities. Although a previous study<sup>14</sup> within the MHS indicated that black women were more likely to receive chemotherapy and less likely to receive hormone therapy compared with white women, treatment was not the main focus of the study, and multivariate comparisons were not conducted. Therefore, it was unclear whether racial variations in breast cancer treatment exist after controlling for possible confounders such as age at diagnosis, tumor stage, and hormone receptor status. Using the combined DoD cancer registry and medical claims data, the aim of this study was to determine whether there were variations in breast cancer treatment between white and black women after adjustment for other variables.

## MATERIALS AND METHODS

This study was based on the linked data from the DoD Central Cancer Registry (CCR) and the MHS data repository (MDR). The CCR was initiated in 1998 and contains information for all cancer patients diagnosed or treated at military treatment facilities among DoD beneficiaries, including active duty military personnel, retired military personnel, and their dependents. Duplicate records pertaining to the same cancer patient were consolidated, and quality assurance was conducted following the guidelines established by the North America Association of Central Cancer Registries. The CCR includes information on demographic variables (eg, age and race), diagnostic factors (eg, date of diagnosis), tumor characteristics (eg, histology and stage), and cancer treatment (eg, surgery, radiation, chemotherapy, and hormonal therapy). The coding of cancer was originally based on the second edition of the International Classification of Diseases for Oncology (ICD-O-2)<sup>16</sup> but was later recoded using the third edition (ICD-O-3).<sup>17</sup> The MDR includes administrative and medical care information from October 1997 for all DoD beneficiaries, including care received at military treatment facilities (direct care) or care received at non-military treatment facilities that is paid for by the DoD (indirect care). The MDR database includes information on clinical diagnoses of all medical conditions, which are coded using the International Clas-

sification of Diseases, 9<sup>th</sup> Revision (ICD-9), and diagnostic and treatment procedures, which are coded using ICD-9 or Current Procedural Terminology codes.

Women were eligible for inclusion in the study if they had received surgical treatment for histologically confirmed local or regional stage, first primary, malignant breast cancer diagnosed between 1998 and 2000. Local stage disease included invasive tumors that were confined to the breast, and regional disease included invasive tumors that had spread beyond the breast either directly or via regional lymph nodes.<sup>18</sup> Distant stage tumors were not included due to limited sample size (white, 59; black, 17).

Demographic variables and tumor characteristic data were obtained from the CCR. Hormone receptor status was considered positive if either estrogen receptor or progesterone receptor status was recorded as positive, negative if both estrogen and progesterone receptor were negative, and unknown if neither measure was recorded. Data on her2/neu expression were not available; therefore, triple-negative status could not be determined. Data on surgery, radiation therapy, and chemotherapy were obtained by combining CCR and MDR data and were considered "yes" if either database recorded their occurrence. Data on hormonal therapy were obtained only from CCR because MDR prescription data were not available until 2002. Treatment within the first 6 months<sup>11,13,19</sup> after diagnosis was determined and compared. Comorbidities were considered present if a diagnosis was recorded in the MDR data in the 12 months prior to breast cancer diagnosis. The level of comorbidity present was categorized according to the Charlson comorbidity index;<sup>20</sup> cancer diagnoses were excluded from the calculation.

Chi-square tests were used to compare basic demographic variables, tumor characteristics, and cancer treatments between black and white women. Logistic regression was used to assess the difference in treatments between white and black women with adjustment for potential confounders. The treatments compared included: 1) mastectomy versus breast-conserving surgery (BCS); 2) mastectomy versus BCS plus radiation (because radiation is conventionally combined with BCS); 3) chemotherapy; and 4) hormonal therapy among those with hormone receptor-positive tumors (because hormonal therapy is conventionally provided only for these tumors). Potential confounders considered included age at diagnosis, tumor stage at diagnosis, comorbidity index, and tumor hormone receptor status. Treatments other than that under assessment were also considered potential

confounders and adjusted for because of their possible relation to both race and the treatment being assessed. Marital status, active duty status, service branch affiliation, and year of diagnosis were also included because of their potentially complex effects on study results. Tumor characteristics other than stage (eg, size and grade) did not appear to be confounders (point estimate for race was not changed more than 10% when variable was included) and thereby were not included in the final logistic regression models. Effect modification of the racial difference in treatment by age, active duty status, tumor stage, and hormone receptor status was assessed by including 2-way interaction terms in the regression models. If the interaction term was statistically significant, then stratified regression models were constructed and reported. All statistical analyses were performed using SAS version 9.1 software (SAS Institute Inc, Cary, NC) and the 2-sided significance level was set at  $P < .05$ .

## RESULTS

Between 1998 and 2000, there were 2781 eligible women diagnosed with breast cancer; of these, 68 white and 14 black women were excluded from the analyses because they did not have medical billing records available, did not have a breast cancer diagnosis in MDR or had breast cancer surgery of unknown type. In total, 2308 (86%) white and 391 (14%) black women were included in the study (Table 1). Black women were significantly younger and more likely to have never been married, be active duty personnel, be an Army beneficiary, have later stage tumors, and have hormone receptor-negative tumors. When stratified by age, hormone receptor-positive tumors remained more common among white women than black women (<50 years, 60% vs 51%,  $P < .01$ ; >50 years, 69% vs 66%,  $P = .07$ ; data not shown). There was no significant racial difference observed for comorbidity, tumor size, or year of diagnosis. Univariate comparisons indicated that black women were more likely to receive mastectomies and chemotherapy but less likely to have radiation and hormonal therapy.

### Type of Surgery

After covariate adjustment, there was no significant difference between black women compared with white women in receipt of mastectomy versus BCS (odds ratio [OR], 0.8; 95% confidence interval [CI], 0.6-1.1) (Table 2). There was also no significant difference after adjustment between black versus white women when mastectomy

without radiation was compared with BCS plus radiation (OR, 1.1; 95% CI, 0.8-1.5).

### Chemotherapy

When assessing the effect of chemotherapy, there was a significant interaction between race and stage of disease ( $P < 0.01$ ). As a result, stage-stratified regression models are reported. Unadjusted racial comparisons among women with localized tumors indicated that black women were more likely to receive chemotherapy than white women (OR, 2.0; 95% CI, 1.5-2.6; data not shown). However, the difference was attenuated and no longer significant (OR, 1.2; 95% CI, 0.9-1.7) after covariate adjustment (Table 3). There was evidence suggestive of a further interaction ( $P = .07$ ) between race and hormonal receptor-positive status (at least 1 positive receptor versus none). Among women with local stage receptor-positive tumors, black women remained significantly more likely than white women to receive chemotherapy (OR, 1.8; 95% CI, 1.2-2.8); no significant racial difference was observed among women with local stage receptor-negative tumors (OR, 0.6; 95% CI, 0.3-1.3; data not shown). Among women with regional stage tumors, unadjusted models did not indicate that there was a significant racial difference (OR, 0.8; 95% CI, 0.5-1.2; data not shown); however, after covariate adjustment, black women were significantly less likely to receive chemotherapy (OR, 0.4; 95% CI, 0.2-0.7; Table 3).

### Hormonal Therapy

When assessing the effect of hormonal therapy, a significant interaction between race and stage of disease ( $P = .02$ ) was detected among receptor-positive women; therefore, stage-stratified regression models are reported in Table 4. Among women with local stage receptor-positive tumors, there was no significant difference between black versus white women in receipt of hormonal therapy (unadjusted OR, 0.7; 95% CI, 0.5-1.1; adjusted OR, 1.0; 95% CI, 0.6-1.4). Among women with regional stage receptor-positive tumors, black women were less likely to receive hormonal therapy (unadjusted and adjusted OR, 0.5; 95% CI, 0.3-0.8).

## DISCUSSION

Black women in the DoD health care system between 1998 and 2000 were more likely to present with later stage, receptor-negative breast cancer tumors than white women. Black women were also younger and

**Table 1.** Comparison of Basic Characteristics by Race Among Department of Defense Beneficiaries Diagnosed With Female Breast Cancer, 1998-2000

Characteristics	White	Black	P <sup>a</sup>
<b>Age, y</b>			
<50	633 (27)	218 (56)	<.01
≥50	1675 (73)	173 (44)	
<b>Marital status</b>			
Married	1834 (79)	301 (77)	<.01
Separated/Divorced/Widowed	363 (16)	56 (14)	
Single, never married	41 (2)	18 (5)	
Unknown	70 (3)	16 (4)	
<b>Comorbidity index<sup>b</sup></b>			
0	1705 (74)	305 (78)	.08
1	361 (16)	44 (11)	
≥2	242 (10)	42 (11)	
<b>Duty status</b>			
Non-active duty	2216 (96)	328 (84)	<.01
Active duty	92 (4)	63 (16)	
<b>Service branch affiliation</b>			
Army	579 (25)	146 (37)	<.01
Air Force	683 (30)	90 (23)	
Marines	75 (3)	16 (4)	
Navy	382 (17)	36 (9)	
Other/Unknown	589 (26)	103 (26)	
<b>Year of diagnosis</b>			
1998	787 (34)	133 (34)	.53
1999	833 (36)	151 (39)	
2000	688 (30)	107 (27)	
<b>Tumor stage</b>			
Local	1637 (71)	223 (57)	<.01
Regional	671 (29)	168 (43)	
<b>Tumor size, cm</b>			
<1	515 (22)	68 (17)	.06
1- $<$ 2	864 (37)	135 (35)	
2- $<$ 3	440 (19)	84 (21)	
3- $<$ 4	180 (8)	41 (10)	
≥4	223 (10)	44 (11)	
Unknown	86 (4)	19 (5)	
<b>Positive lymph nodes</b>			
0	1427 (62)	193 (49)	<.01
1	236 (10)	60 (15)	
2-3	186 (8)	48 (12)	
4-9	133 (6)	43 (11)	
10-74	93 (4)	14 (4)	
Unknown	233 (10)	33 (8)	
<b>Tumor grade</b>			
1	503 (22)	51 (13)	<.01
2	836 (36)	134 (34)	
3-4	646 (28)	150 (38)	
Unknown	323 (14)	56 (14)	
<b>Hormone receptor status</b>			
ER+ and/or PR+	1535 (67)	222 (57)	<.01
ER- and PR-	345 (15)	80 (20)	
Unknown	428 (19)	89 (23)	

(Continued)

**Table 1.** (Continued)

Characteristics	White	Black	P <sup>a</sup>
<b>Surgery/Radiation</b>			
Mastectomy only	1045 (45)	182 (47)	<.01
Mastectomy plus radiation	176 (8)	37 (9)	
BCS only	300 (13)	68 (17)	
BCS plus radiation	787 (34)	104 (27)	
<b>Chemotherapy</b>			
No	1161 (50)	139 (36)	<.01
Yes	1147 (50)	252 (64)	
<b>Hormonal therapy</b>			
No	1319 (57)	268 (69)	<.01
Yes	847 (37)	103 (26)	
Unknown	142 (6)	20 (5)	

Abbreviations: BCS, breast-conserving surgery; ER, estrogen receptor; PR, progesterone receptor.

Data are presented as no. (%).

<sup>a</sup>Chi-square test.<sup>b</sup>Charlson comorbidity index excluding cancer diagnoses from the calculation.

more likely to be active duty personnel at the time of diagnosis. When these factors were taken into account, there was no significant difference in the type of surgery received, particularly when mastectomy was compared with BCS plus radiation. The racial difference in receipt of chemotherapy varied by stage and hormone receptor status. Among women with localized tumors, the racial difference was apparent only for receptor-positive tumors; black women tended to be more likely to receive chemotherapy than white women. However, among women with regional tumors, black women were less likely to receive chemotherapy than white women. Additionally, black women with receptor-positive, regional stage tumors were less likely to receive hormonal therapy than white women.

In 1990, the National Institutes of Health Consensus Panel recommended BCS plus radiation in lieu of mastectomy for the surgical treatment of early breast cancers. The recommendation was made because BCS plus radiation was less invasive while providing equivalent survival.<sup>21</sup> However, because of the lack of difference in survival, the decision to have BCS versus mastectomy likely reflects an individual's choice due to various factors (eg, breast preservation versus side effects from radiation therapy). Although black women historically were less likely to have BCS, our findings are in agreement with more recent studies that have found similar surgery choices by race.<sup>10,22,23</sup>

Overall, there was no racial difference in the receipt of chemotherapy or hormonal therapy among women

**Table 2.** Adjusted Odds of Surgery Among Department of Defense Beneficiaries Diagnosed With Female Breast Cancer, 1998-2000

Characteristics	Mastectomy vs BCS (n=2699)		Mastectomy Without Radiation vs BCS With Radiation (n=2118)	
	OR (95% CI)	P	OR (95% CI)	P
<b>Race</b>				
White	Reference		Reference	
Black	0.8 (0.6-1.1)		1.1 (0.8-1.5)	
<b>Age, y</b>				
<50	Reference		Reference	
≥50	0.7 (0.6-0.9)	<.05	0.9 (0.7-1.2)	
<b>Marital status</b>				
Married	Reference		Reference	
Separated/Divorced/Widowed	0.9 (0.6-1.3)		1.3 (0.9-1.7)	
Single, never married	0.6 (0.3-1.2)		1.0 (0.5-2.0)	
Unknown	0.6 (0.4-1.1)		0.9 (0.5-1.5)	
<b>Comorbidity index<sup>a</sup></b>				
0	Reference		Reference	
1	1.1 (0.9-1.5)		1.0 (0.8-1.3)	
≥2	1.3 (1.0-1.8)	<.05	1.1 (0.8-1.5)	
<b>Duty status</b>				
Non-active duty	Reference		Reference	
Active duty	0.9 (0.6-1.4)		0.7 (0.4-1.1)	
<b>Service branch affiliation</b>				
Army	Reference		Reference	
Air Force	0.9 (0.7-1.2)		0.9 (0.7-1.2)	
Marines	1.1 (0.6-2.0)		1.3 (0.7-2.2)	
Navy	1.0 (0.7-1.3)		0.9 (0.7-1.2)	
Other/Unknown	1.2 (0.9-1.6)		1.1 (0.8-1.5)	
<b>Year of diagnosis</b>				
1998	Reference		Reference	
1999	1.1 (0.8-1.3)		1.0 (0.8-1.2)	
2000	0.8 (0.6-1.0)		0.9 (0.7-1.1)	
<b>Tumor stage</b>				
Local	Reference		Reference	
Regional	2.3 (1.9-3.0)	<.05	2.6 (2.1-3.3)	<.05
<b>Hormone receptor status</b>				
ER+ and/or PR+	Reference		Reference	
ER- and PR-	0.9 (0.6-1.1)		0.9 (0.7-1.2)	
Unknown	1.0 (0.8-1.2)		0.8 (0.6-1.0)	
<b>Radiation</b>				
No	Reference		—	
Yes	0.1 (0.1-0.1)	<.05	—	
<b>Chemotherapy</b>				
No	Reference		Reference	
Yes	1.4 (1.1-1.7)	<.05	1.4 (1.1-1.8)	<.05
<b>Hormonal therapy</b>				
No	Reference		Reference	
Yes	1.7 (1.3-2.1)	<.05	0.9 (0.7-1.1)	
Unknown	0.7 (0.4-1.0)		0.9 (0.6-1.4)	

Abbreviations: BCS, breast-conserving surgery; CI, confidence interval; ER, estrogen receptor; OR, odds ratio; PR, progesterone receptor.

Logistic regression analysis was used to control for the effects of all listed variables.

<sup>a</sup>Charlson comorbidity index excluding cancer diagnoses from the calculation.

**Table 3.** Adjusted Odds of Chemotherapy by Demographic and Clinical Characteristics Among Department of Defense Beneficiaries Diagnosed With Female Breast Cancer, 1998-2000

Characteristics	Local Stage Disease (n=1860)		Regional Stage Disease (n=839)	
	OR (95% CI)	P	OR (95% CI)	P
<b>Race</b>				
White	Reference		Reference	
Black	1.2 (0.9-1.7)		0.4 (0.2-0.7)	<.05
<b>Age, y</b>				
<50	Reference		Reference	
≥50	0.3 (0.2-0.4)	<.05	0.2 (0.1-0.3)	<.05
<b>Marital status</b>				
Married	Reference		Reference	
Separated/Divorced/Widowed	0.4 (0.2-0.6)	<.05	0.3 (0.2-0.6)	<.05
Single, never married	0.7 (0.3-1.6)		0.8 (0.2-3.3)	
Unknown	0.7 (0.4-1.2)		0.4 (0.1-1.4)	
<b>Comorbidity index<sup>a</sup></b>				
0	Reference		Reference	
1	0.9 (0.6-1.2)		0.6 (0.3-1.0)	
≥2	0.8 (0.6-1.2)		0.8 (0.4-1.6)	
<b>Duty status</b>				
Non-active duty	Reference		Reference	
Active duty	1.7 (1.0-3.0)	<.05	0.8 (0.2-3.0)	
<b>Service branch affiliation</b>				
Army	Reference		Reference	
Air Force	0.9 (0.7-1.2)		0.9 (0.5-1.6)	
Marines	0.5 (0.2-1.0)		3.9 (0.5-30.5)	
Navy	0.9 (0.7-1.3)		1.2 (0.6-2.7)	
Other/Unknown	1.0 (0.7-1.5)		1.3 (0.7-2.6)	
<b>Year of diagnosis</b>				
1998	Reference		Reference	
1999	1.6 (1.2-2.1)	<.05	1.2 (0.7-1.9)	
2000	1.9 (1.5-2.5)	<.05	1.4 (0.8-2.4)	
<b>Hormone receptor status</b>				
ER+ and/or PR+	Reference		Reference	
ER- and PR-	3.3 (2.4-4.5)	<.05	2.1 (1.0-4.5)	<.05
Unknown	1.1 (0.8-1.5)		0.9 (0.5-1.6)	
<b>Surgery/Radiation</b>				
Mastectomy only	Reference		Reference	
Mastectomy plus radiation	1.4 (0.8-2.5)		0.9 (0.5-1.6)	
BCS only	0.7 (0.5-1.0)		0.8 (0.4-1.6)	
BCS plus radiation	0.6 (0.5-0.8)	<.05	1.0 (0.5-1.7)	
<b>Hormonal therapy</b>				
No	Reference		Reference	
Yes	0.4 (0.3-0.6)	<.05	0.3 (0.2-0.4)	<.05
Unknown	0.5 (0.3-0.7)	<.05	0.6 (0.3-1.6)	

Abbreviations: BCS, breast-conserving surgery; CI, confidence interval; ER, estrogen receptor; OR, odds ratio; PR, progesterone receptor.

Logistic regression analysis was performed to control for the effects of all listed variables.

<sup>a</sup> Charlson comorbidity index excluding cancer diagnoses from the calculation.

with local stage disease. These findings are in agreement with a previous study.<sup>10</sup> Racial differences in receipt of chemotherapy were, however, observed among women with local stage, hormone receptor-positive tumors.

Within this subgroup, black women were more likely to have chemotherapy (OR, 1.8; 95% CI, 1.2-2.8). This racial variation in treatment may be partially due to black women having more advanced within-stage tumors; 24%

**Table 4.** Adjusted Odds of Hormonal Therapy by Demographic and Clinical Characteristics Among Department of Defense Beneficiaries Diagnosed with ER and/or PR Positive Female Breast Cancer, 1998-2000

Characteristics	Local Stage Disease (n=1208)		Regional Stage Disease (n=549)	
	OR (95% CI)	P	OR (95% CI)	P
<b>Race</b>				
White	Reference		Reference	
Black	1.0 (0.6-1.4)		0.5 (0.3-0.8)	<.05
<b>Age, y</b>				
<50	Reference		Reference	
≥50	1.3 (1.0-1.8)	<.05	1.5 (1.0-2.4)	<.05
<b>Marital status</b>				
Married	Reference		Reference	
Separated/Divorced/Widowed	0.6 (0.4-0.9)	<.05	0.8 (0.4-1.4)	
Single, never married	0.7 (0.3-1.8)		1.1 (0.4-3.0)	
Unknown	1.0 (0.5-1.9)		0.7 (0.1-2.9)	
<b>Comorbidity index<sup>a</sup></b>				
0	Reference		Reference )	
1	1.4 (1.0-1.9)	<.05	0.7 (0.4-1.2)	
≥2	0.8 (0.6-1.2)		0.8 (0.4-1.5)	
<b>Duty status</b>				
Non-active duty	Reference			
Active duty	1.0 (0.5-1.9)		1.7 (0.7-4.2)	
<b>Service branch affiliation</b>				
Army	Reference		Reference	
Air Force	1.2 (0.9-1.6)		0.9 (0.6-1.4)	
Marines	0.8 (0.4-1.5)		0.5 (0.2-1.5)	
Navy	1.1 (0.8-1.6)		0.9 (0.5-1.7)	
Other/Unknown	1.6 (1.1-2.4)	<.05	1.1 (0.6-2.0)	
<b>Year of diagnosis</b>				
1998	Reference		Reference	
1999	1.2 (0.9-1.6)		1.3 (0.9-2.0)	
2000	1.0 (0.7-1.3)		1.0 (0.6-1.6)	
<b>Surgery/Radiation</b>				
Mastectomy only	Reference		Reference	
Mastectomy plus radiation	0.9 (0.4-1.6)		1.1 (0.7-1.8)	
BCS only	0.7 (0.5-1.0)		0.4 (0.2-0.8)	<.05
BCS plus radiation	1.0 (0.8-1.3)		1.6 (1.0-2.6)	<.05
<b>Chemotherapy</b>				
No	Reference		Reference	
Yes	0.5 (0.4-0.7)	<.05	0.4 (0.3-0.6)	<.05

Abbreviations: BCS, breast-conserving surgery; CI, confidence interval; ER, estrogen receptor; OR, odds ratio; PR, progesterone receptor.

Logistic regression analysis was performed to control for the effects of all listed variables.

<sup>a</sup> Charlson comorbidity index excluding cancer diagnoses from the calculation.

of these black women had tumors of grade 3/4 compared with 16% of white women ( $P = .01$ ; data not shown). When adjusted for tumor grade, the racial difference was attenuated but remained significant (OR, 1.6; 95% CI, 1.0-2.5).

Among women with regional stage tumors, black women were less likely to receive chemotherapy or hor-

monal therapy. These findings are similar to previous findings,<sup>10,12,14</sup> but our study suggests that accessibility to medical care may not account for the racial differences. No significant difference by tumor grade, tumor size, or number of positive lymph nodes was observed between the 2 racial groups ( $P > .05$ ; data not shown); as such, tumor presentation does not appear to explain the observed

differences in the aggressiveness of the treatment. Although the reasons for the observed differences are unknown, they may be multifactorial. Previous research has shown that white women tend to talk to their physicians more about the rationale for chemotherapy and tamoxifen use, and are therefore more likely to receive these treatments.<sup>24</sup> It is unclear, however, whether physicians' treatment recommendations vary by patients' race. There is also evidence that racial differences exist in the perceived benefits of receiving adjuvant therapy. For example, Schleinitz et al<sup>25</sup> observed that black women were less likely than white women to associate chemotherapy with improved quality of life. In addition, a patient's choice of treatment is likely influenced by a combination of factors that can vary by race, including knowledge of treatment options, cost burden, cultural and spiritual beliefs, and social support.<sup>26-29</sup>

The main strength of the present study was the use of data from a health care system based on equal access regardless of race. Our finding of racial differences in treatment suggests that factors other than medical care access warrant further research. Additionally, the ability to adjust for demographic variables, tumor characteristics, and comorbidities was made possible through the combined use of cancer registry and medical administrative databases. Limitations of the study include those inherent in using medical administrative databases, such as incomplete data, coding inaccuracies, and errors. Again, however, these limitations were minimized by combining the administrative data with the cancer registry data. A theoretical concern that completeness of case records might vary by calendar year was addressed by examination of the data after elimination of the first year's data. When the cases diagnosed in 1998 were excluded from the analyses, the study inferences did not change. There is still a possibility of incomplete data if patients have other health insurance and seek care elsewhere; if such incompleteness is differential by race, the results might be affected. For example, if whites have greater access to other health care and are more likely to be diagnosed and treated elsewhere, the estimated racial differences in treatment for regional stage disease may be underestimated.

In conclusion, among women with equal health care access, variations between white and black women were observed for the receipt of chemotherapy and hormonal therapy. Studies that identify the driving factors behind these racial disparities are needed. In the meantime, targeted education for black women—especially women

with regional disease—concerning the benefits of chemotherapy and hormonal therapy may decrease the observed racial differences.

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## CONFLICT OF INTEREST DISCLOSURES

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